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## Sources of variability in the ionospheric spatio/temporal scales measured by Swarm instrument suite

Jaroslav Urbar<sup>1</sup>, Luca Spogli<sup>1,6</sup>, Antonio Cicone<sup>4,1</sup>, Lasse Clausen<sup>2</sup>, Yaqi Jin<sup>2</sup>, Alan Wood<sup>3</sup>, Lucilla Alfonsi<sup>1</sup>, Claudio Cesaroni<sup>1</sup>, James Rawlings<sup>5</sup>, Daria Kotova<sup>2</sup>, Per Høeg<sup>2</sup>, and Wojciech Miloch<sup>2</sup>

<sup>1</sup>Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy (jaroslav.urbar@gmail.com)

<sup>2</sup>University of Oslo, Norway

<sup>3</sup>University of Birmingham, United Kingdom

<sup>4</sup>University of L'Aquila, Italy

<sup>5</sup>Nottingham Trent University, United Kingdom

<sup>6</sup>SpacEarth Technology, Italy

The ionosphere is a dynamical system exhibiting nonlinear couplings with the other “spheres” characterizing the geospace environment. Such nonlinearity manifests also through the non-trivial, largely varying range of spatial and temporal scales. We investigate how the different scales of the *in situ* plasma density as provided by different data products measured by Swarm satellites relate to the same range of scales of the field-aligned currents from Swarm FAC dataset and how their intensifications reflect the various conditions of the geospace.

The present study compares the spatio-temporal variability in the topside ionosphere by leveraging on the Fast Iterative Filtering (FIF) technique. FIF is able to reveal the hidden features of a time series, as it decomposes any nonstationary, nonlinear signals, like those provided by Langmuir probes onboard Swarm, into oscillating modes, called intrinsic mode components or functions (IMCs or IMFs), characterized by their specific frequencies.

The instantaneous time-frequency representation of the IMFs is provided through the so-called “IMFogram” which illustrates the time development of the multi-scale processes. The IMFogram has the potentiality to show the finer details of the scale sizes which intensify during the various phases of geomagnetic storms.

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